Saving Windows, Saving Money. Evaluating the Energy Performance of Window Retrofit and Replacement

AEESOC Chapter Meeting - June 1, 2017

David Katz & Andre Zupancic

Agenda

- Introduction to Fenestration and Windows
- What does CMHC and NRCan say about windows?
- Recent studies and recommendations
- Environmental Product Declaration and Net Zero - LEED & BOMA Best
- RetScreen Expert window module
- Magnetite options and benefits
- Utility Incentives and GHG reduction funding programs
- Questions !

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Types of Fenestrations

Fenestrations

- Windows
  - Fixed
  - Casement
  - Awning
  - Dual Action / Tilt and Turn
  - Sliding (Vertical and Horizontal)
  - Combination (Combo)
- Doors
- Skylights/Sloped Glazing
  - Architectural Systems
  - Structural Systems

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NRCan Fenestration Information

- **Factors affecting energy efficiency**
- **Energy balance**
  All fenestration products experience some heat loss:
- **radiation**—heat energy is absorbed by the glass and radiates toward the cooler side
- **conduction**—heat energy moves through solid materials that make up the frame, sash or spacer bars
- **convection**—heat energy is transferred to the air between and around the glass
- **air leakage**—heat energy is transferred to air moving through seals or gaps in the frame
- Windows can also gain passive solar energy through the glass to help offset energy costs during the heating season. This balance is reflected in the energy-performance ratings.

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What is are Window Problems?

Low R value:

Single Pane glass in metal, wood or fibreglass frames. Builder choose lowest first cost just to meet code:

Condensation:

Delta Temperature from inside to outside in cold weather leads to condensation on interior and/or between double panes when seals are broken.

Leakage:

Every window assembly has places of separation whether fixed or operable. The places of connection in window assemblies and to the building envelope deteriorate over time. Constant air exchange occurs.

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What is are Window Solutions?

- ***Replace your existing windows with New Windows***
- ***Exterior Storm windows for the low rise homes that are easily accessible.***
  High rise buildings would not have exterior storms installed.
- ***Interior Storm Window Panels using magnetic seals and other adhesion methods.***
- ***Insulating blinds that save energy but are not transparent and are not always opened or closed when needed.***
- ***Window Film and new nano coatings. Offer improvement in SHGC and lower air conditioning costs but trade off heating savings.***
- ***Weather stripping and Caulking are options to seal around the windows.***

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What does CMHC say about Windows?

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Business / Government / Housing Organizations

Add Storm Windows to Single-Glazed Units

The Measure

Installing storm windows (or a second layer of glazing) to interior or exterior of existing window.

Application

Buildings where complete window replacement cannot be justified.

Benefits

- Improved condensation resistance.
- Increased resident comfort.
- Reduced heating costs.
- Reduced moisture damage.
- Improved overall serviceability of windows.
- Increased resident satisfaction with windows.

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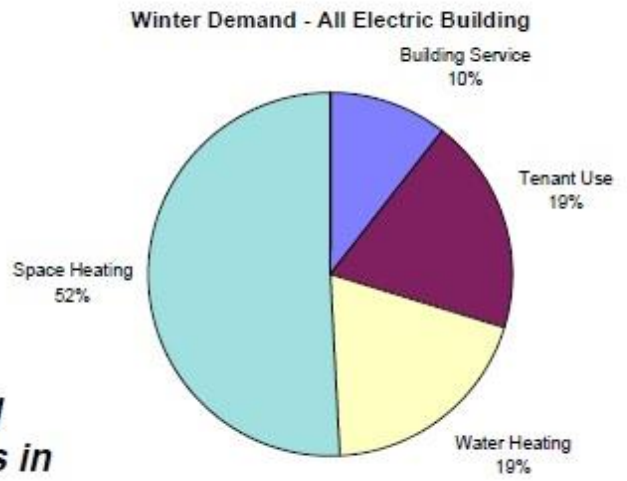
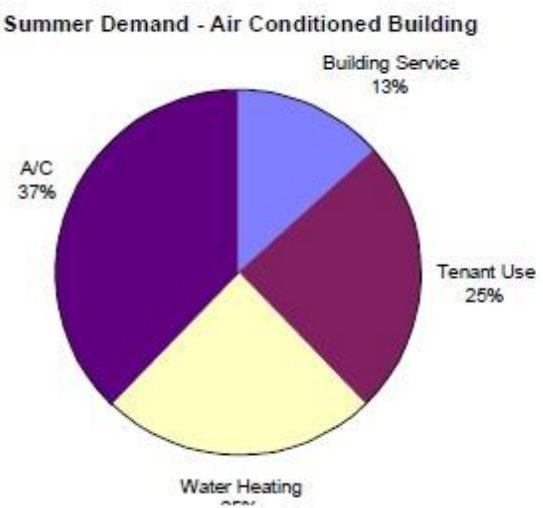
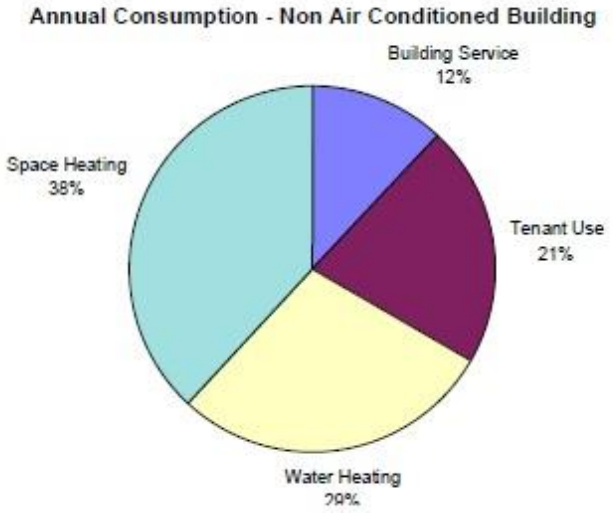
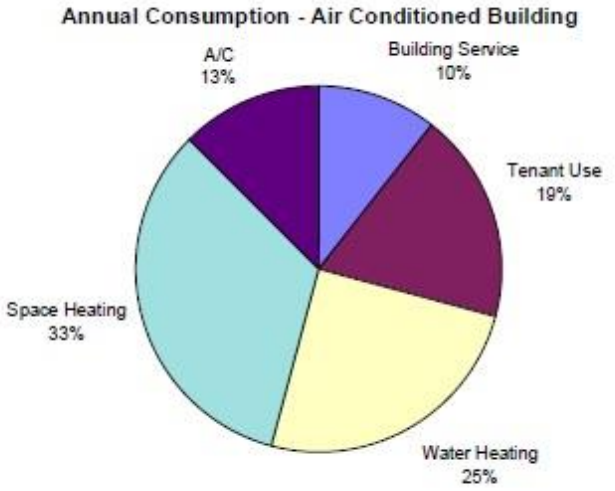
What does CMHC say about Energy in Multi Res?

Typical Energy Consumptions and Electrical Demands in Multi-Residential Buildings









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What does NRCan say about Windows?

Natural Resources Canada | Ressources naturelles Canada

Improving Window Energy Efficiency

Why Should I Worry About My Windows?

Windows can account for up to 25 percent of total house heat loss. This fact sheet describes affordable and effective options to improve the energy efficiency of the windows in your house.

"My heating bills are out of this world. What's the problem?"

— Heat loss through and around your windows is costing you more money than you might think.

"I can't sit beside some of the windows in my home because of their cold surfaces and drafts."

— Cold air entering your house through cracks and crevices around windows can make for an uncomfortable living environment.

"Condensation and frost on my windows are creating mould and rotting the frames."

— Excessive condensation can be a sign that a window needs some work.

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Recent Study on the Window Solutions

Saving Windows, Saving Money:

Evaluating the Energy Performance of Window Retrofit and Replacement

A REPORT BY:

National Trust *for* Historic Preservation
Preservation Green Lab

FUNDED BY:

NCPTT
National Center for Preservation Technology and Training

IN PARTNERSHIP WITH:

CASCADIA
GREEN BUILDING COUNCIL

ECOTOPE
Consulting
Research
Design

- Multiple window improvement options, comparing the relative energy, carbon, and cost savings of various choices across multiple climate regions.
- *Results shows that a number of existing window retrofit strategies come very close to the energy performance of high-performance replacement windows at a fraction of the cost.*

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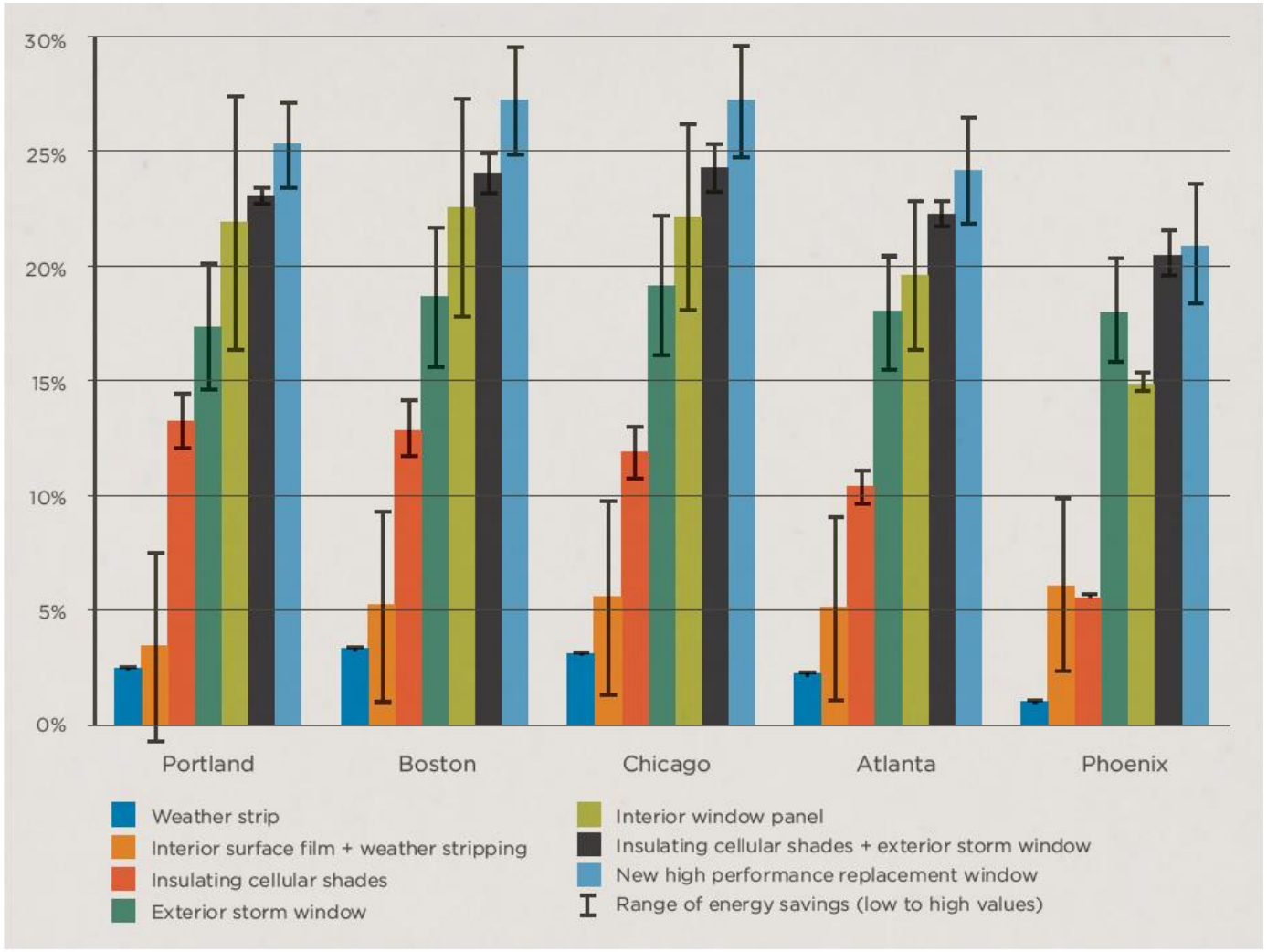
Annual Percent Energy Savings For Various Window Upgrade Options



Note: Percentage savings are not intended to predict actual savings. Instead, the results are meant to be used to evaluate the relative performance of measures where other more cost-effective energy saving strategies have been implemented first.

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Figure 7: Average Initial Costs of Window Options For All Cities

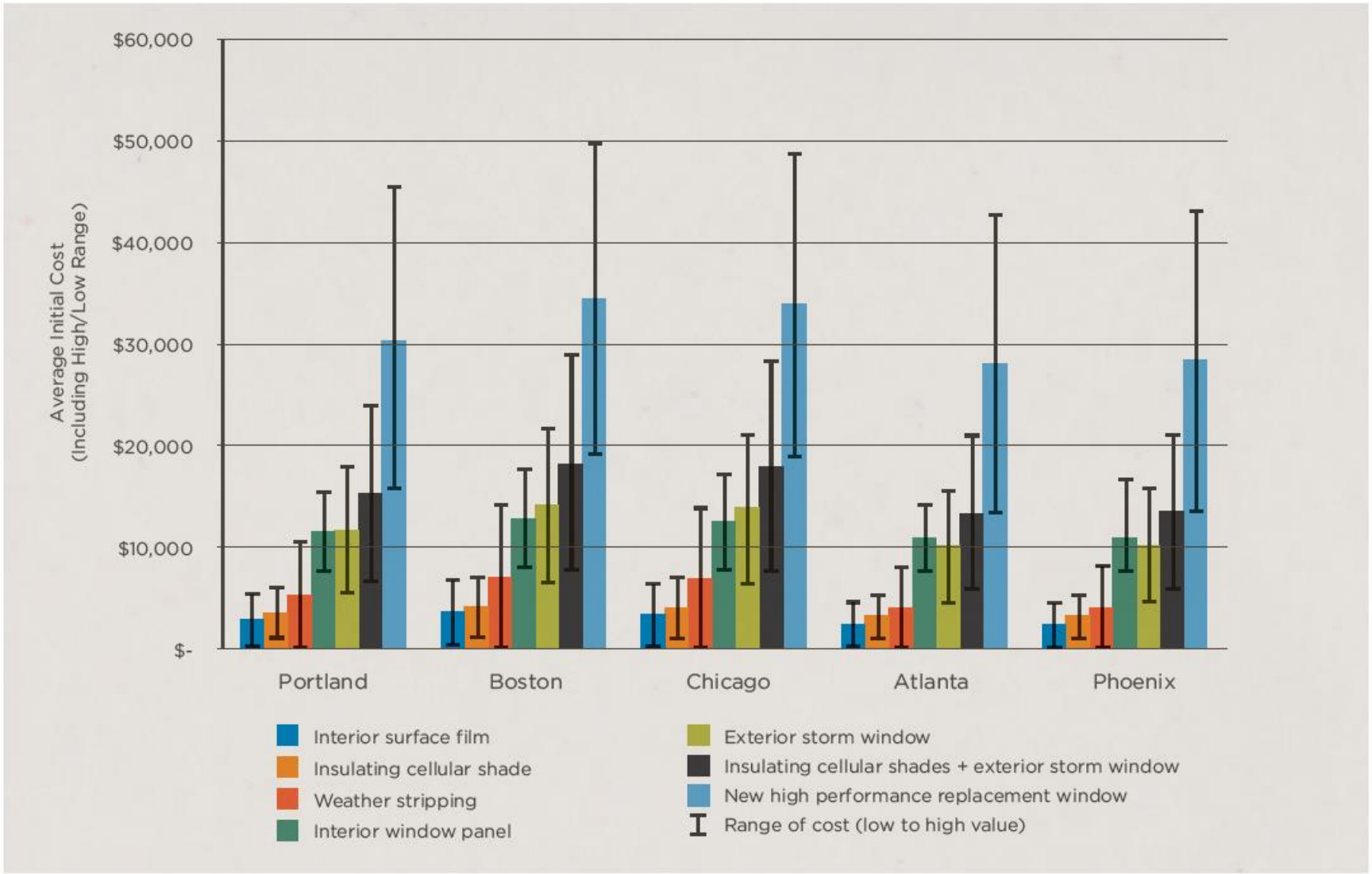

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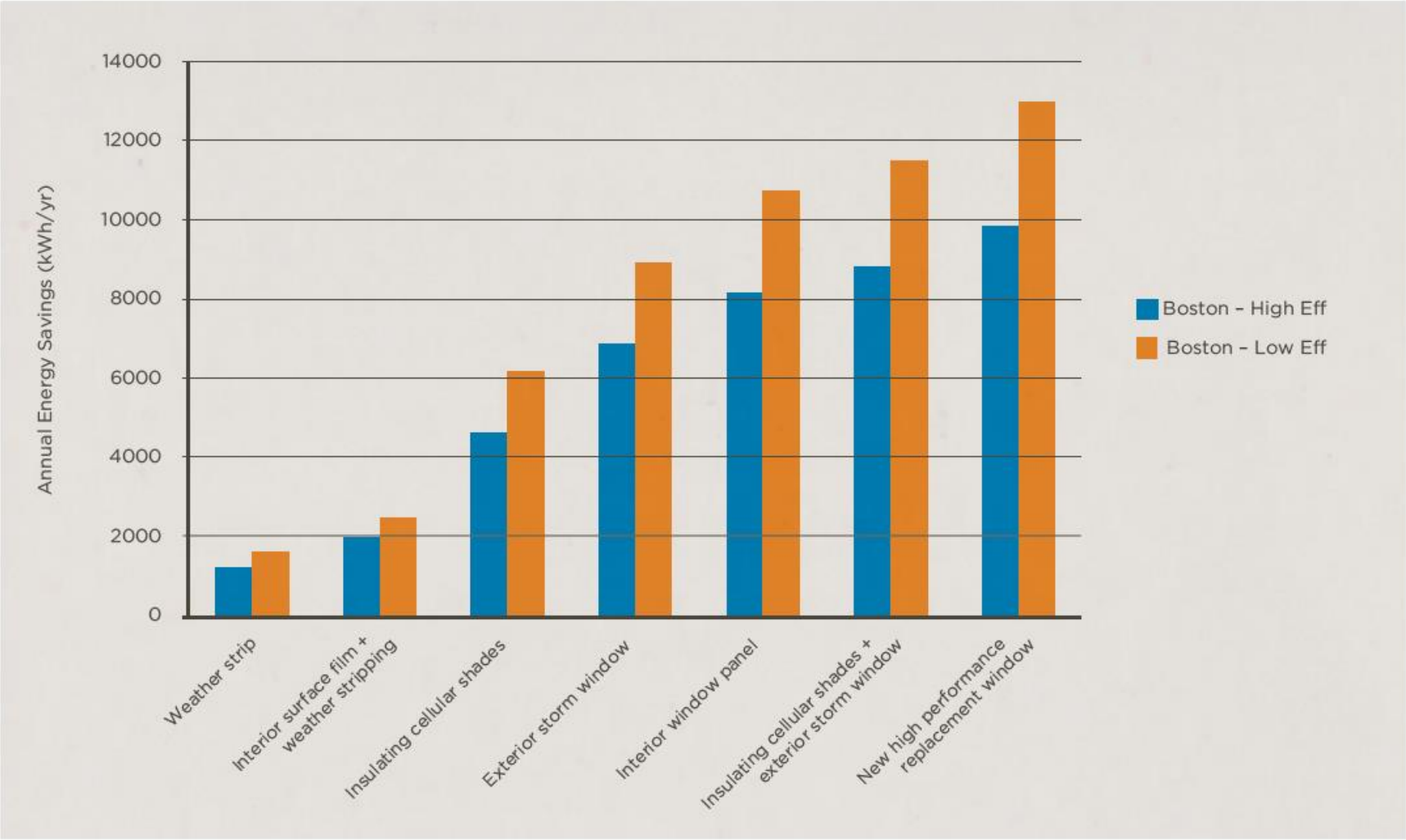
Figure 12: Average Energy Savings (kWh/yr) over baseline for low and high efficiency HVAC



This graph charts the average kWh savings per year that the baseline home is expected to realize with various window improvement measures. The blue bars represent energy savings when the home is assumed to have a high efficiency heating system; the red bars represent savings for the home with a low efficiency heating system. These results show that the savings from upgrading windows is diminished if a home's heating system has already been upgraded. While this graph shows simulation results for Boston, the influence of equipment efficiency on the window savings applies to the other cities studied in proportion to their heating load.

Options and Ratings used in NPHS Simulation Model

1 Baseline: Double hung single pane window – U value = 0.77 SHGC 0.74

Air leakage range at 50 psi = 646 tight to 1360 leaky

2 Weather-strip, Seal and Repair Existing Window –

A: Metal interlocking gasketed professionally installed weather-stripping – U value 0.77 SHGC 0.74

B: Owner installed rubber or felt gaskets“ U value 1.05 SHGC 0.74

Air leakage range at 50 psi = 156 tight to 812 leaky

3 Exterior Storm Window:

A: Low-E double pane operable exterior storm - U value 0.21 SHGC 0.27

B: Single-Clear Operable exterior Storm U value 0.55 SHGC 0.31

Air leakage range at 50 psi = 307 tight to 1027 leaky

4 Interior Storm Window:

A: Low-E single pane fixed interior storm - U value 0.36 SHGC 0.39

B: Single-Clear Operable Internal Storm - U value 0.48 SHGC 0.60

Air leakage range at 50 psi = 203 tight to 456 leaky

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Options and Ratings used in NPHS Simulation Model

1

5 Insulating Cellular Shades [1], night-time/daytime values

A: With Side Tracks + Existing Single Clear Glazing U value 0.26/0.77 SHGC 0.74

B: Without Side Tracks + Existing Single Clear Glazing - U value 0.58/1.05 SHGC 0.74

Air leakage range at 50 psi = 156 tight to 1360 leaky

6 Insulating Cellular Shades with Exterior Storm, night-time/daytime values.

A: With Side Tracks + Double Low-e Exterior Storm - U value 0.12/0.21 SHGC 0.27

B: Without Side Tracks + Single Clear Exterior Storm - U value 0.22/0.55 SHGC 0.31

Air leakage range at 50 psi = 156 tight to 1360 leaky

7 ***Interior Surface Film + Weather-Stripping - U value 0.55 SHGC 0.47***

Air leakage range at 50 psi = 156 tight to 812 leaky

8 New High Performance Window

A: Double Glazed Double Hung Fiber-glass Window - U value 0.24 SHGC 0.39

B: Double Glazed Double Hung Fiber-glass Window - U value 0.35 SHGC 0.24

Air leakage range at 50 psi = 38 tight to 44 leaky

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Recommendations and Conclusion

Upgrading windows (specifically older, single-pane models) with high performance enhancements can result in substantial energy savings across a variety of climate zones.

Selecting options that retain and retrofit existing windows are the most cost effective way to achieve these energy savings and to lower a home's carbon footprint.

Due to the cost and complexity of upgrading windows, however, these options are not likely to be the first intervention that homeowners undertake.

For many older homes, non-window-related interventions—including air sealing, adding insulation, and upgrading heating and cooling systems—offer easier and lower cost solutions to reducing energy bills.

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U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Energy Savings from Window Attachments

October 2013

DOE Study - A more comprehensive study of many options and many ways windows would be operated in many different climate zones.

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Another US study with comprehensive modeling of many scenarios

- Total annual energy use for houses with each shading device in several configurations and climates.
- 16,848 energy simulation runs were carried out for 12 climate zones,
- Four house types, three baseline windows, 11 window attachment categories
- Four attachment qualities and varying number of deployment positions.
- One option for fixed, three options for cellular shades, roller screens, solar screens, and drop-arm awnings
- Eight options for horizontal and vertical louvered blinds.

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North Climate Zone Energy savings Results for Comparison to Canada

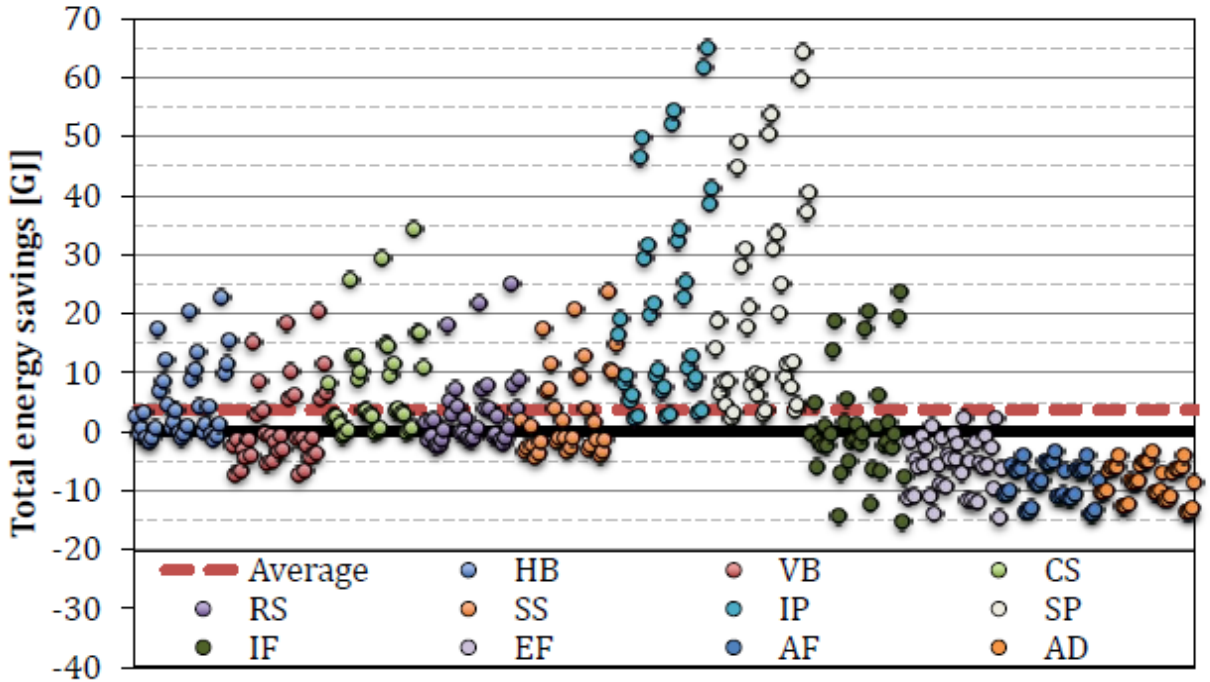

Figure 15. North Climate Zone. Average Savings: 3.72 GJ

HB	Horizontal Louvered Blind	IP	Interior Window Panel
VB	Vertical Louvered Blind	SP	Storm Panel
CS	Cellular Shade	IF	Interior Applied Film
RS	Roller Shade	EF	Exterior Applied Film
SS	Solar Screen	AF	Fixed Awning
		AD	Drop-arm Awning

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6.3 Energy Savings Tables

The following tables show energy savings compared to the baseline case without any attachment installed. The values displayed are for the following house type: slab, gas heating, and electric A/C. See Appendix A for results for all 12 cities.

Table 21. Single Glazing -Total Energy Savings [GJ] Compared to an Un-Shaded Baseline for All Attachment Types in a House with Slab, Gas Heating, and Electric A/C, for Four Attachment Qualities (A, B, C, D).

Attachment Type	Minn				Washington.DC				Phoenix			
	A	B	C	D	A	B	C	D	A	B	C	D
Horizontal Blind	22.8	9.8	11.5	15.4	16.4	12.0	11.2	8.0	14.8	6.3	7.5	10.1
Vertical Blind	20.5	5.5	11.4	6.4	16.3	12.3	11.1	11.8	12.7	2.6	7.4	3.0
Cellular Shade	34.3	16.9	16.7	10.9	18.5	13.1	11.5	6.5	22.9	11.4	11.3	7.6
Roller Shade	25.0	7.7	4.0	8.9	18.0	11.7	8.8	4.4	16.1	4.9	2.9	5.9
Solar Screen	23.8	10.4	10.1	14.6	17.0	13.6	12.8	10.1	15.6	6.2	6.3	9.6
Interior Window Panel	61.7	65.0	38.6	41.3	24.6	17.8	12.6	10.5	38.6	39.6	23.6	24.8
Storm Window	59.8	64.4	37.1	40.5	25.7	18.5	13.9	11.6	37.4	39.4	22.8	24.4
Interior Applied Film	19.3	23.6	-15.4	-7.9	18.2	9.9	7.9	4.2	12.7	15.1	-9.1	-4.2
Exterior Applied Film	-9.7	2.2	-14.6	-6.3	12.2	5.1	8.5	4.5	-4.2	3.2	-8.8	-3.3
Fixed Awning	-14.1	-14.1	-13.4	-8.2	9.5	9.5	9.2	6.4	-8.3	-8.3	-7.9	-4.5
Droparm Awning	-13.6	-13.6	-13.1	-8.5	8.2	8.2	8.1	6.7	-9.6	-9.6	-9.2	-6.0

Table 22. Double Clear Glazing -Total Energy Savings [GJ] Compared to an Un-Shaded Baseline for All Attachment Types in a House with Slab, Gas Heating, and Electric A/C, for Four Attachment Qualities (A, B, C, D).

Attachment Type	Minn				Washington.DC				Phoenix			
	A	B	C	D	A	B	C	D	A	B	C	D
Horizontal Blind	4.3	0.1	1.3	4.1	10.2	7.4	6.5	3.4	3.3	0.4	1.3	2.9
Vertical Blind	-1.2	-7.3	-1.2	-6.7	10.0	8.0	6.2	7.5	-1.1	-5.4	-0.4	-5.1
Cellular Shade	11.4	3.4	3.8	3.2	11.8	7.6	6.3	2.9	8.3	2.9	3.0	2.3
Roller Shade	3.8	-0.9	-0.5	2.6	11.8	7.5	5.4	1.8	2.6	-0.2	0.1	1.7
Solar Screen	3.7	-3.0	-2.3	1.6	11.2	9.4	8.9	6.6	2.9	-2.0	-1.3	1.5
Interior Window Panel	22.6	25.5	10.9	12.6	15.1	10.0	6.3	4.8	15.3	16.4	7.3	8.0
Storm Window	20.0	24.9	9.0	11.4	16.4	10.2	8.1	6.0	13.8	16.2	6.4	7.6
Interior Applied Film	0.9	6.1	-6.9	-2.3	11.3	4.6	5.7	2.0	1.7	4.4	-3.2	-0.9
Exterior Applied Film	-11.7	-1.9	-12.0	-5.5	10.0	4.0	8.0	4.8	-5.9	0.1	-6.5	-2.5
Fixed Awning	-11.4	-11.4	-10.8	-6.3	8.7	8.7	8.5	5.8	-6.3	-6.3	-5.9	-3.0
Droparm Awning	-11.5	-11.5	-11.0	-7.0	7.8	7.8	7.8	6.4	-7.6	-7.6	-7.3	-4.4
No Shade	92.1	92.1	92.1	92.1	47.4	47.4	47.4	47.4	56.7	56.7	56.7	56.7

Table 14. U-factor / SHGC for Attachment and Double Clear Glazing System Combinations

Product	Emissivity		Transmittance		Reflectance		Angle	U-factor (Btu/h-ft2-F)		SHGC	
	High	Low	High	Low	High	Low		Low	High	Low	High
Baseline window								0.49		0.59	
Horizontal blind	0.9	0.1	0.05	0	0.9	0.1	0	0.45	0.46	0.55	0.58
							45	0.43	0.45	0.33	0.51
							90	0.36	0.42	0.12	0.46
Vertical blind	0.9	0.1	0.05	0	0.9	0.1	0	0.46	0.46	0.59	0.59
							45	0.44	0.46	0.38	0.52
							90	0.36	0.42	0.12	0.46
Roller Shades	0.9	0.1	0.5	0	0.8	0.05	N/A	0.29	0.46	0.14	0.54
Cellular Shades	0.9	0.1	0.5	0	0.8	0.1	N/A	0.20	0.43	0.15	0.48
Interior Applied Film	0.9	0.02	0.6	0.2	0.6	0.1	N/A	0.39	0.49	0.23	0.51
Storm Windows	0.9	0.05	0.7	0.2	0.6	0.1	N/A	0.20	0.37	0.19	0.46
Interior Window Panel	0.9	0.05	0.7	0.2	0.6	0.1	N/A	0.20	0.37	0.24	0.51
Exterior Applied Film	0.9	0.02	0.6	0.2	0.6	0.1	N/A	0.48	0.49	0.18	0.46
Exterior Solar Screens	0.9	0.1	0.5	0.1	0.8	0.05	N/A	0.32	0.40	0.10	0.34

Interior panels were amongst the highest performers for energy savings

4.5.6 Interior Window Panels

Interior (indoor-mounted) window panels are always fully deployed. They are considered to be tightly attached to the baseline window with no gaps around the edges. Gap of 1 in. between the prime glass and the interior window panel is considered for all qualities.

Table 12. Interior Window Panel Definition of Range of Qualities

Quality	Emissivity (Ext/Int) [-]	Reflectance [-]	Transmittance [-]	Conductivity k, [W/m·K]	#Panes	Deployed
A	0.05 / 0.1	0.6	0.2	0.15	2	Full
B	0.07/0.15	0.2	0.6	1.0	2	Full
C	0.84	0.3	0.6	1.0	1	Full
D	0.9	0.1	0.7	1.0	1	Full

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Annual Percent Energy Savings For Various Window Upgrade Options

Exterior (outdoor-mounted) attachments are generally more effective in saving cooling energy, but not always the highest overall energy savings due to a potential increase (penalty) in heating energy.

In north and largely central climate zones, heating energy use is higher than cooling energy, so a combination of insulating properties and balanced solar control saves the most energy.

Insulating interior window panels, exterior storm panels and cellular shades are most effective in these localities.

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Environmental Factors – GHG and Life Cycle Assessment

Reusing existing windows has other advantages beyond operational energy and cost savings.

Keeping existing windows saves the energy and resources that would be needed to create a new window.

Production of replacement windows requires materials, and these materials generate CO2 and other environmental hazards from the extraction, manufacture, transport, and disposal processes.

Retrofit measures also require materials, but are often less materials intensive and have less of an environmental impact than an entire window replacement.

Following is the Environmental Product Declaration (EPD) of an Italian Window Component Maker as the EPD is common in Europe.

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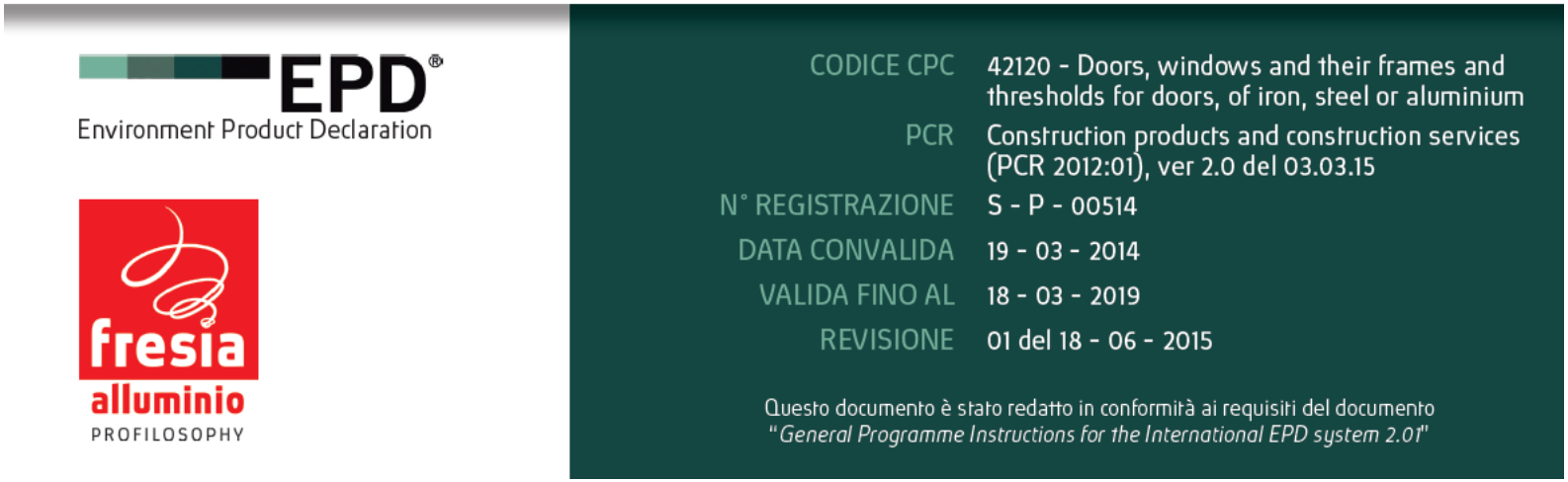
Environmental Product Declaration- LEED and Other Programs



Fresia Alluminio is an Italian leading company in the design and marketing of high energy-efficient window aluminium profiles.

The present EPD includes four different series of aluminium profiles: Planet Neo 62, Planet Neo 72, Slide Neo 106, Sirio Neo 50.

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Environmental Product Declaration- LEED and Other Programs

Declared unit

Data are referred to 1 kg of product and related packaging. The following table describes the relationship between the declared unit (1 kg) and the profile length (1 m) of each product series.

	Total [kg/m]	Al [kg/m]	Polyamide [kg/m]	Paint[19] [kg/m]	Packaging [kg/m]
Planet NEO 62	1,87	1,51	0,22	0,085	0,054
Planet NEO 72	1,98	1,34	0,49	0,092	0,058
Slide NEO 106	2,12	1,76	0,20	0,098	0,062
Sirio NEO 50	1,70	1,57	Not included	0,078	0,049

Environmental impact

Impact category	Unit	Total value (Cradle to Gate)			
		Planet NEO 62	Planet NEO 72	Slide NEO 106	Sirio NEO 50
Global Warming Potential (GWP)	[kg CO2-Equiv.]	7,78	8,08	7,78	7,78
Ozone Depletion Potential (ODP)	[mg R11-Equiv.]	0,54	0,46	0,56	0,62
Acidification Potential (AP)	[g SO2-Equiv.]	31,00	31,11	31,09	31,71
Eutrophication Potential (EP)	[g PO_4^{2-}-Equiv]	1,99	2,52	1,92	1,61

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Zero Carbon CAGBC - LEED and Other Programs

Zero Carbon Buildings Framework Definition of a Zero Carbon Building:

A highly energy efficient building that produces on-site, or procures, carbon-free renewable energy in an amount sufficient to offset the annual carbon emissions associated with building operations.

An embodied carbon metric Rationale:

While this work focuses on the GHG emissions associated with building operations, as these emissions decrease, a greater focus will be placed on carbon emissions associated with the materials used in building construction.

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What is Magnetite?

Magnetite storm window insulating panels are a unique interior mounted acrylic window panel that attaches and seals magnetically around the entire perimeter of a window.

Our technology is endorsed by **Natural Resources Canada** and **CMHC**.

Magnetite is a patented system that has been installed in residential and commercial properties for the last 35 years in Canada, the US and Australia.

CSA (Canadian Standards Association) tested as the only window product to allow 0 air infiltration.

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Magnetite R/U-value CSA Test Results

Configuration #1:	3 mm Generic Clear Glass / 16.2 mm Air Gap / 3 mm Generic Clear Glass
Configuration #2:	3 mm Generic Clear Glass / 16.2 mm Argon Gas Gap / 3 mm Generic Clear Glass
Configuration #3:	3 mm Generic Clear Glass / 16.2 mm Air Gap / 3 mm Cardinal LoE180 [3]
Configuration #4:	3 mm Generic Clear Glass / 16.2 mm Argon Gap / 3 mm Cardinal LoE180 [3]
Configuration #5:	3 mm Generic Clear Glass / 16.2 mm Air Gap / 3 mm Generic Clear Glass / 66 mm Air Gap / Magnetite Acrylic Panel / 29 mm Air Gap / Magnetite Acrylic Panel
Configuration #6:	3 mm Generic Clear Glass / 16.2 mm Argon Gas Gap / 3 mm Generic Clear Glass / 66 mm Air Gap / Magnetite Acrylic Panel / 29 mm Air Gap / Magnetite Acrylic Panel
Configuration #7:	3 mm Generic Clear Glass / 16.2 mm Air Gap / 3 mm 3 mm Cardinal LoE180 [3] / 66 mm Air Gap / Magnetite Acrylic Panel / 29 mm Air Gap / Magnetite Acrylic Panel
Configuration #8:	3 mm Generic Clear Glass / 16.2 mm Argon Gas Gap / 3 mm 3 mm Cardinal LoE180 [3] / 66 mm Air Gap / Magnetite Acrylic Panel / 29 mm Air Gap / Magnetite Acrylic Panel

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Magnetite R/U-value CSA Test Results

3.0 RESULTS

Table 1 – Summary of Centre-of-Glass Results (Only)

IGU Configuration	No. of Layers	Overall Thickness (mm)	Glazing 1 Thickness (mm)	Glazing 2 Thickness (mm)	Acrylic Panel 3 & 4 Thickness (mm)	Keff (W/m-K)	U-Value (W/m^2-K)	SHGC	Visible Transmission
1	2	22.23	3.0	3.0	-	0.086	2.74	0.76	0.88
2	2	22.23	3.0	3.0	-	0.078	2.61	0.76	0.88
3	2	22.23	3.0	3.0	-	0.043	1.79	0.68	0.78
4	2	22.23	3.0	3.0	-	0.034	1.53	0.68	0.78
5	4	123.45	3.0	3.0	3.0	0.191	1.24	0.59	0.67
6	4	123.45	3.0	3.0	3.0	0.186	1.21	0.59	0.68
7	4	123.45	3.0	3.0	3.0	0.139	0.96	0.55	0.63
8	4	123.45	3.0	3.0	3.0	0.125	0.88	0.56	0.64

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Magnetite Leakage CSA Test Results

Test	Requirements	Test Results	Rating
Air Leakage Resistance (Clause: 5.3.2) **Test Date:** June 20, 2014	**Maximum Allowable Air Leakage:** 1.5 L/s m^2 @ 75 Pa Canadian Air Infiltration / Exfiltration Levels (R-Class): A2 Level: < 1.5 L/s m^2 A3 Level: < 0.5 L/s m^2 Fixed Level: < 0.2 L/s m^2	**Specimen Configuration:** **With Acrylic Pane Off** Infiltration Q = 0.19 L/s m^2 Exfiltration Q = 0.42 L/s m^2 Average Q = 0.30 L/s m^2 @ 75 Pa Unit Area = 1.84 m^2	**Meets Gateway:** HS-R **Canadian Level:** A3
Air Leakage Resistance (Clause: 5.3.2) **Test Date:** June 20, 2014	**Maximum Allowable Air Leakage:** 1.5 L/s m^2 @ 75 Pa Canadian Air Infiltration / Exfiltration Levels (R-Class): A2 Level: < 1.5 L/s m^2 A3 Level: < 0.5 L/s m^2 Fixed Level: < 0.2 L/s m^2	**Specimen Configuration:** **With Acrylic Panel On** Infiltration Q = 0.01 L/s m^2 Exfiltration Q = 0.00 L/s m^2 Average Q = 0.01 L/s m^2 @ 75 Pa Unit Area = 1.84 m^2	**Meets Gateway:** HS-R **Canadian Level:** A3

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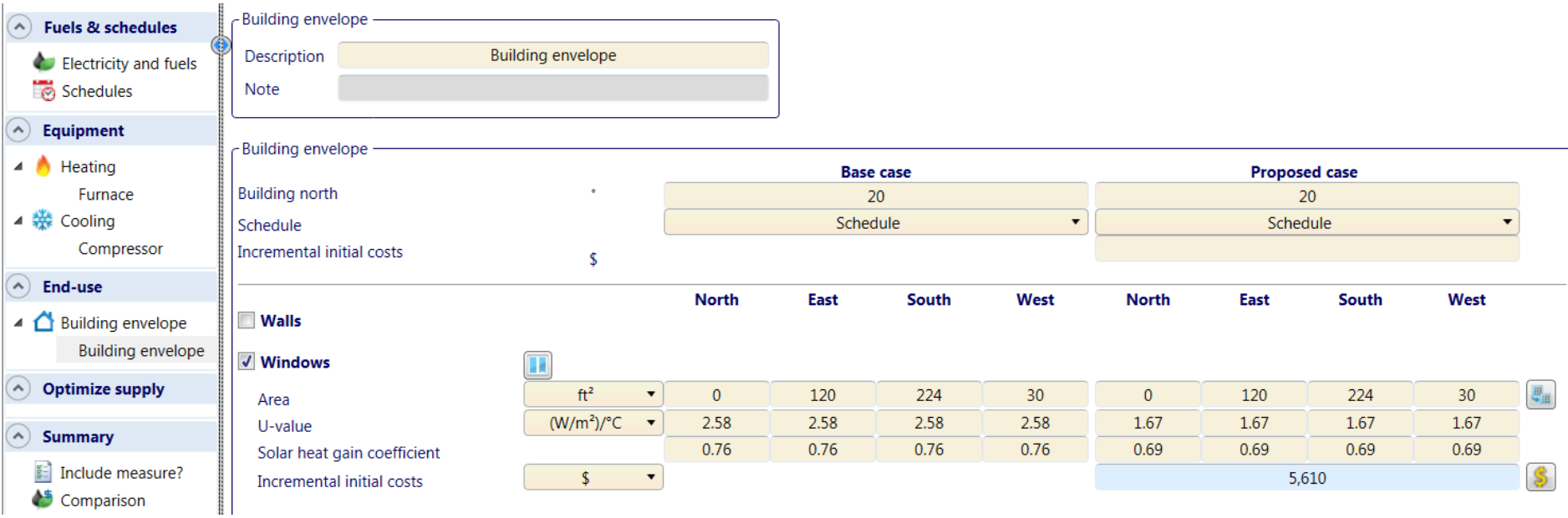
Recent RetScreen Expert Reports



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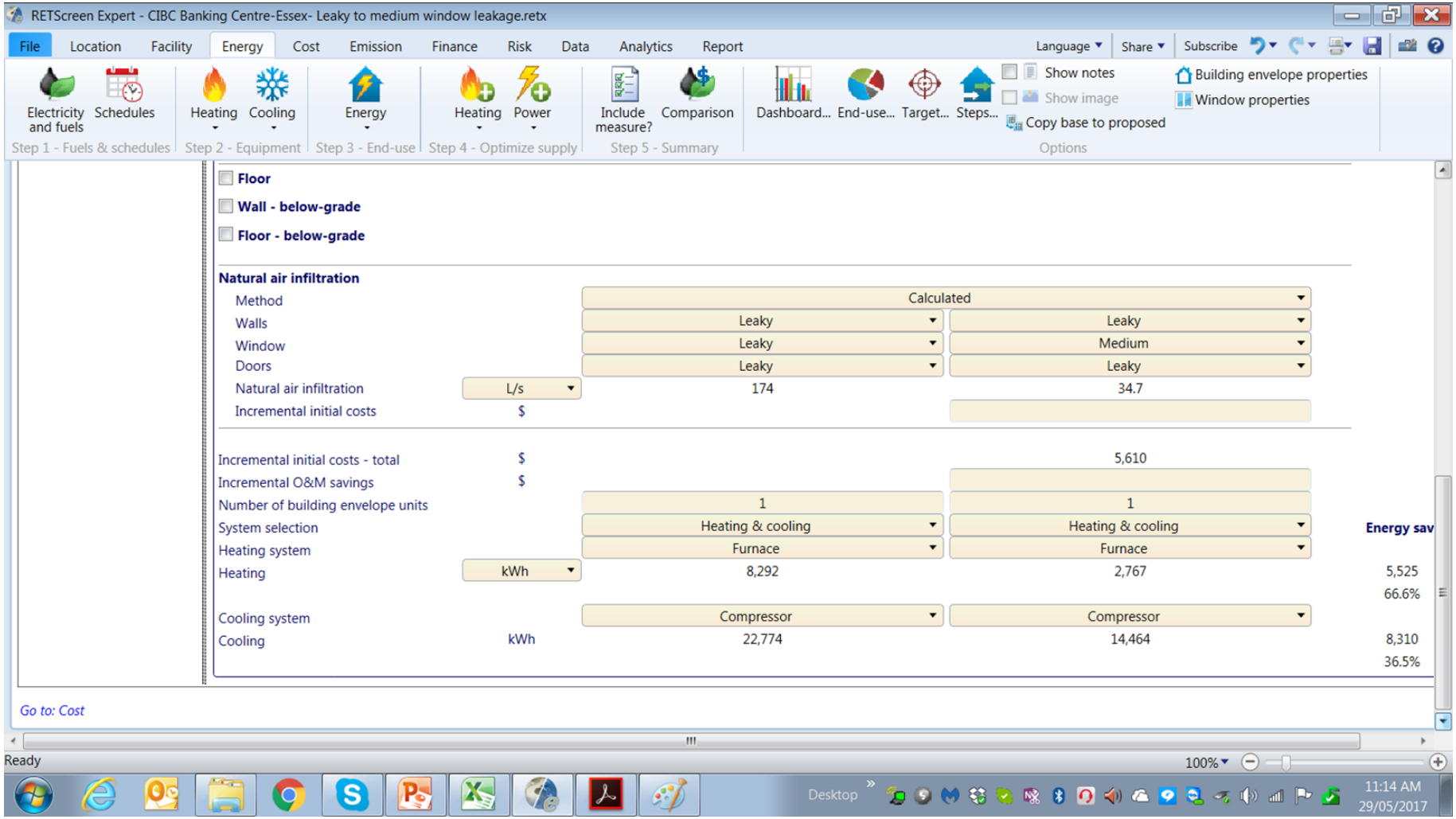

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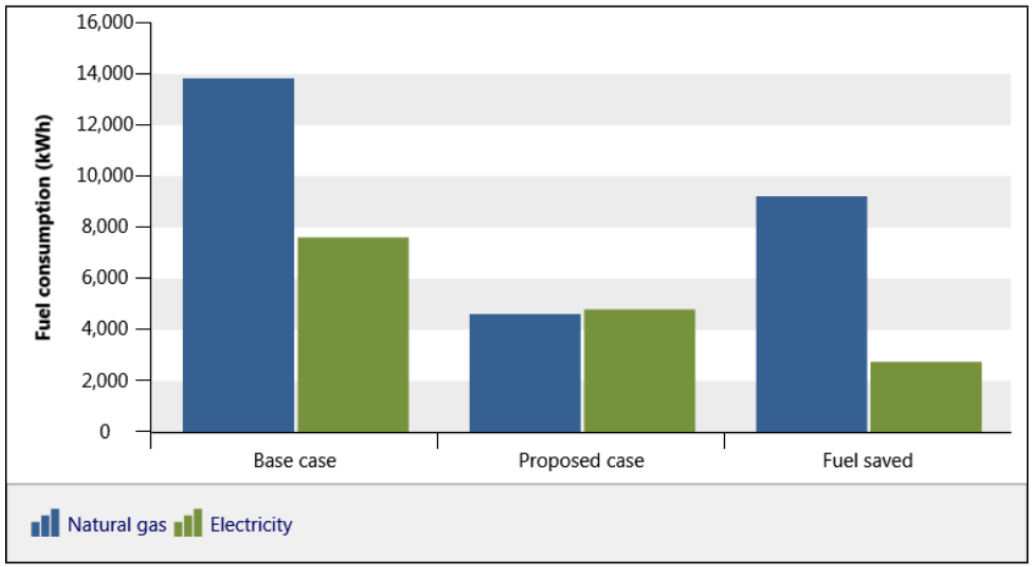
Fuel summary



CIBC Bank in ESSEX

Fuel type	Fuel Unit	Base case Fuel consumption	Proposed case Fuel consumption	Savings Fuel saved
Natural gas	m^3	1,327	443	884
Electricity	kWh	7,591	4,821	2,770

Fuel type	Fuel Fuel rate	Base case Fuel cost	Proposed case Fuel cost	Savings Savings
Natural gas	0.38 $/$m^3$	$ 504	$ 168	$ 336
Electricity	0.18 $/kWh	$ 1,366	$ 868	$ 499
Total		$ 1,871	$ 1,036	$ 835

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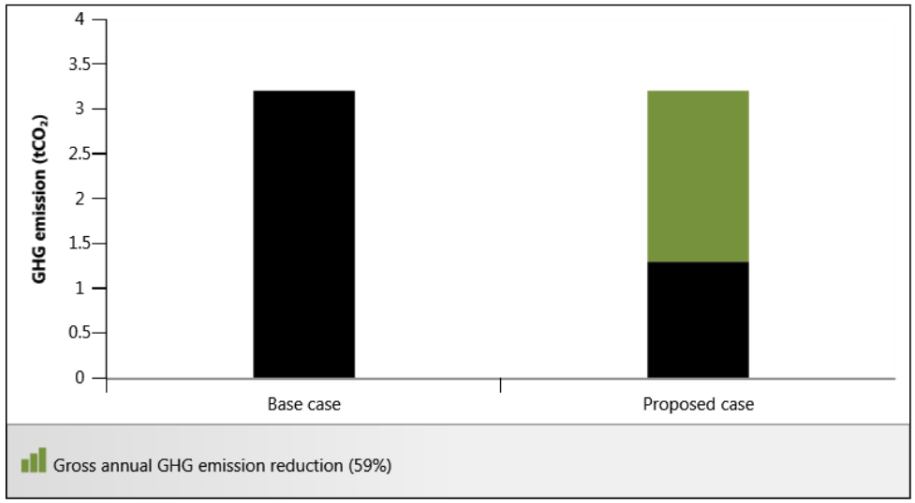
Recent RetScreen Expert Reports

GHG emission



CIBC Bank in ESSEX

GHG equivalence

1.9 tCO_2 is equivalent to 0.4
Cars & light trucks not used

GHG emission		
Base case	3.2	tCO_2
Proposed case	1.3	tCO_2
Gross annual GHG emission reduction	1.9	tCO_2

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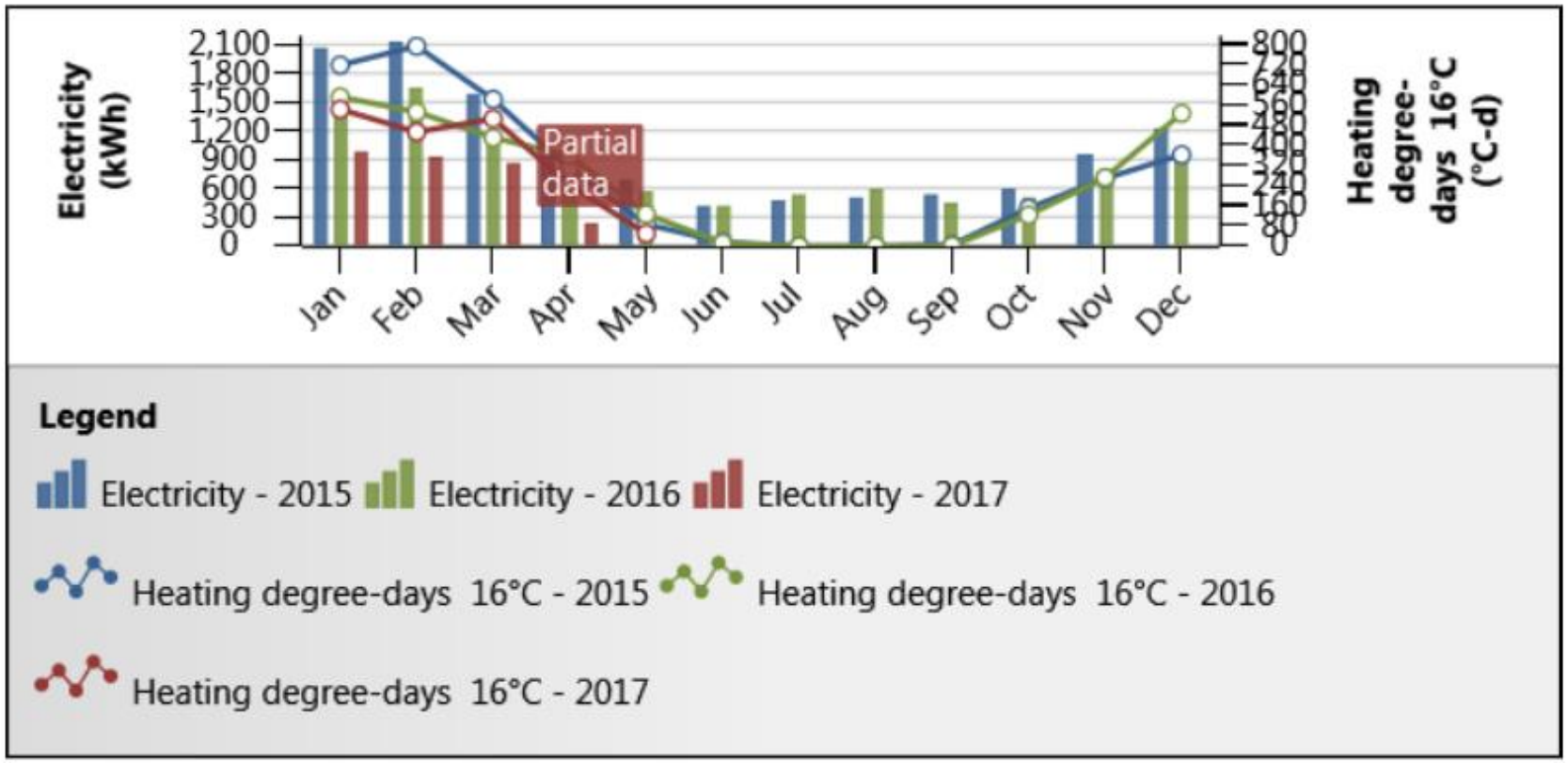
Recent RetScreen Expert Reports

Condo Unit Performance

Monthly bar graph



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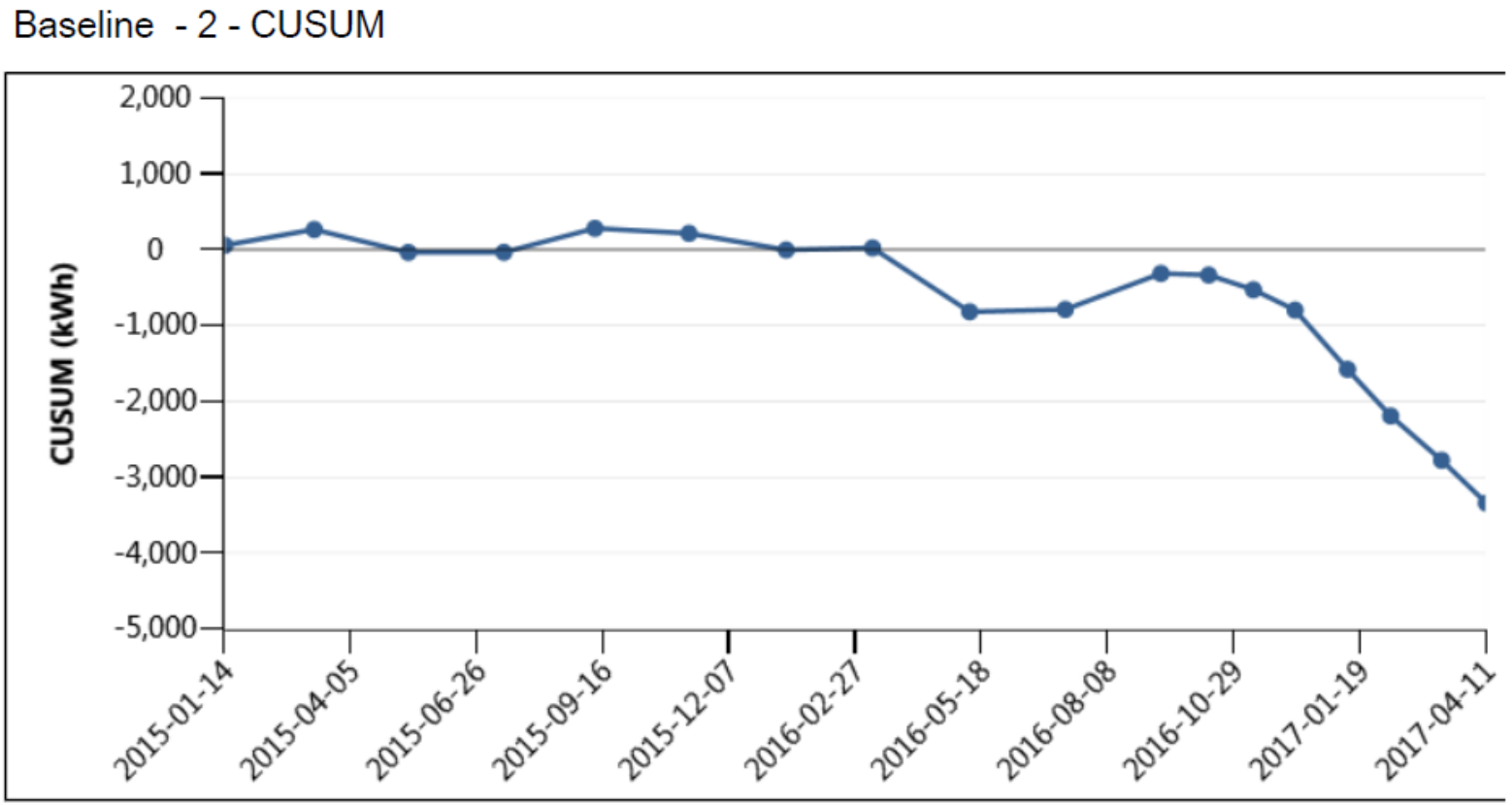
Recent RetScreen Expert Reports

Electric Heat Condo Unit Performance



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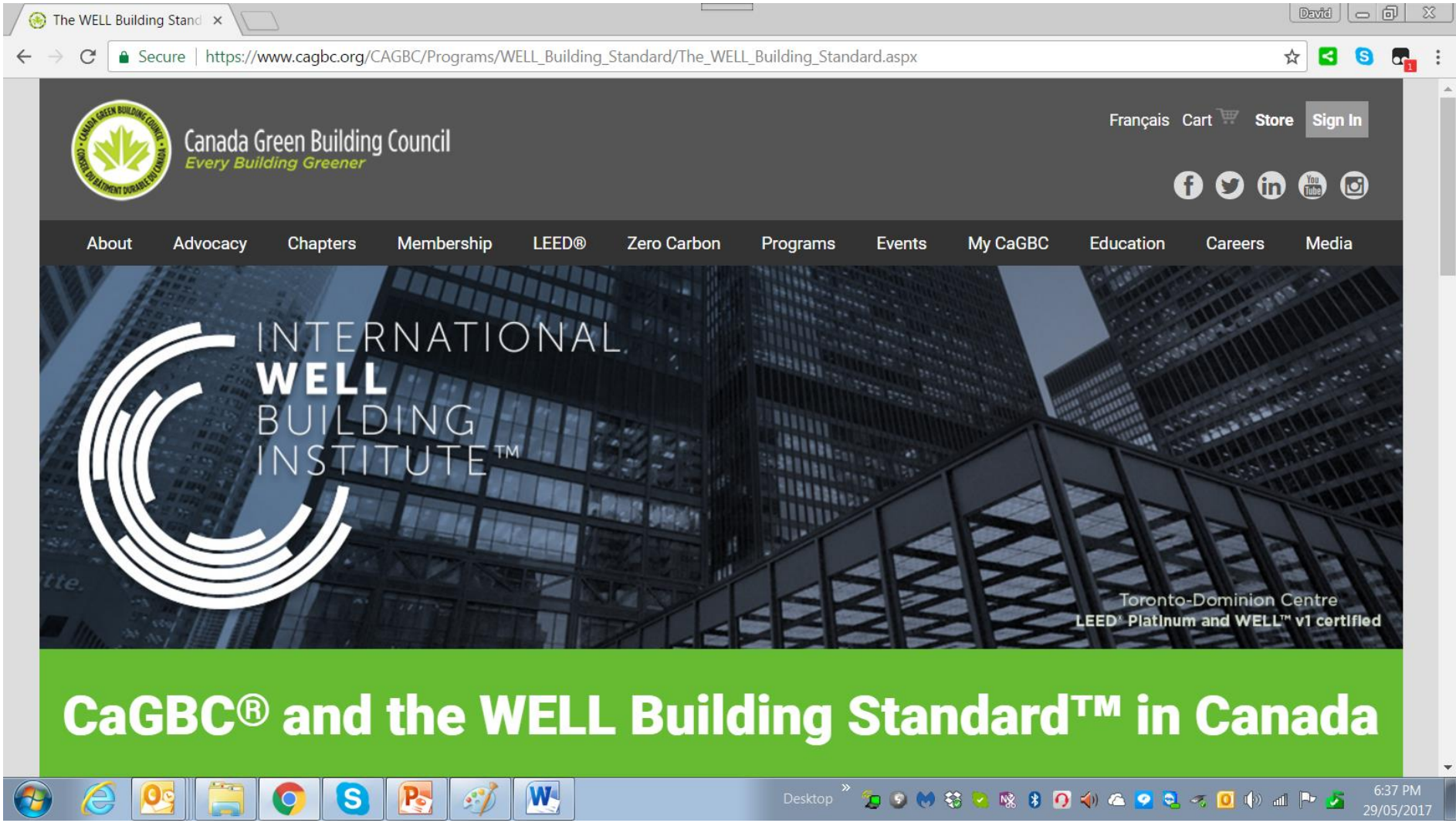
Magnetite for Sound Reduction and WELL Rating



Magnetite for Sound Reduction and WELL Rating

Comfort				
72	Accessible design	P	P	P
73	Ergonomics: visual and physical		P	P
74	Exterior noise intrusion	P	O	P
75	Internally generated noise	O	P	P
76	Thermal comfort	P	P	P
77	Olfactory comfort		O	O
78	Reverberation time		O	O
79	Sound masking		O	O
80	Sound reducing surfaces		O	O
81	Sound barriers		O	O
82	Individual thermal control		O	O
83	Radiant thermal comfort	O	O	O

Built environments can harbor sounds that are distracting and disruptive to work or relaxation. Employee surveys show that acoustic problems are a leading source of dissatisfaction within the environmental conditions of an office.

As acoustic comfort is determined in part by the physical properties and contents of environments, the WELL Building Standard aims to shape spaces to mitigate unwanted indoor noise levels and reduce exterior noise intrusion in order to enhance social interaction, learning, satisfaction and productivity.

ASTM E90 Test Results – Airborne Sound Transmission Loss

Client: Magnetite Canada **Test ID:** TLA-16-064

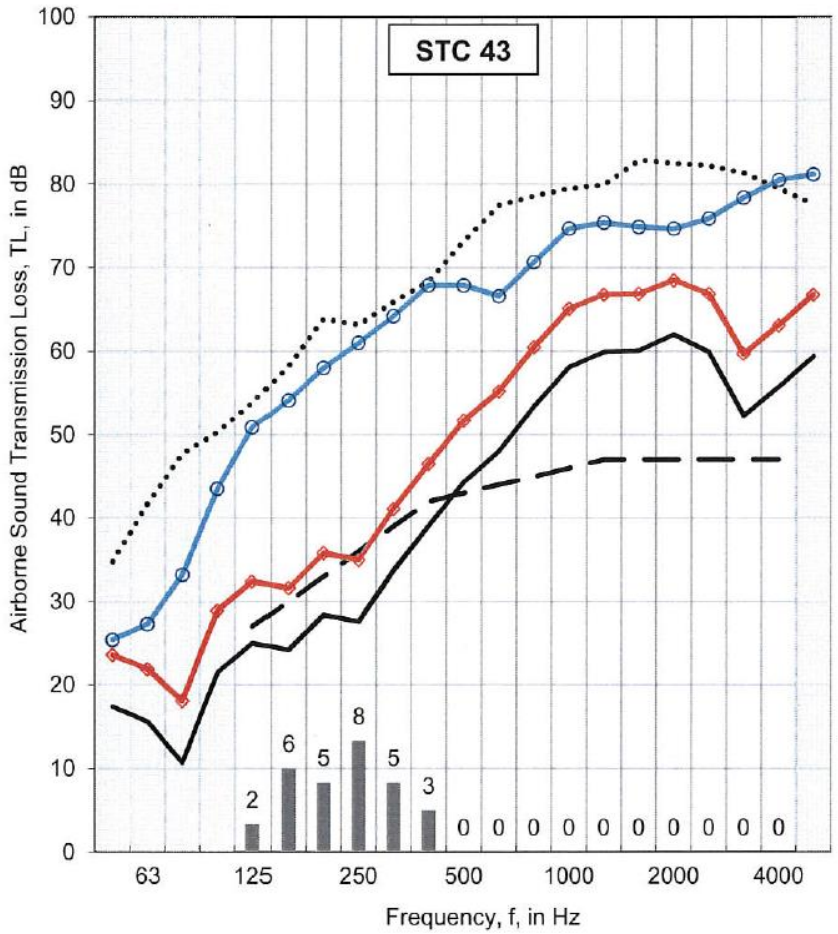
Specimen ID: A1-009464-1WM **Date of Test:** August 19, 2016

Room	Volume (m^3)	Air Temperature (°C)	Humidity (%)
Large	254.9	21.8 to 22	67.7 to 67.8
Small	140.6	21.5 to 21.5	65.4 to 65.6

Area of test specimen:	1.61 m^2
Mass of test specimen:	13.6 kg

f (Hz)	TL (dB)	
50	17	min
63	16	clc
80	11	
100	22	
125	25	
160	24	
200	28	
250	28	
315	34	
400	39	
500	44	
630	48	clc
800	53	clc
1000	58	clc
1250	60	clc
1600	60	clc
2000	62	clc
2500	60	clc
3150	52	
4000	56	
5000	59	
Sound Transmission Class (STC)	43	

Sum of Deficiencies (dB)
29
Max. Deficiency (dB)
8 dB at 250 Hz



Sound Reduction Test in NRC Lab. For both single and double pane windows with and without Magnetite

Sound Reduction Project in Australia

Magnetite installed retrofit double glazing to 363 windows (avg size 3 sqm) from levels one to nine.

Scratch resistant acrylic glazing, custom-manufactured by Mitsubishi Rayon, was imported exclusively for this project.

The air cavities created were maximised to achieve the best acoustic results.

Magnetite addressed both energy savings and acoustics required to achieve a 5 Stars NABERS energy rating as well as a 5 Star Green Star rating.

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Sound Reduction Project

Magnetite CANADA

The Technology

Our technology provides all the benefits of double and triple glazing without replacing the existing window. This allows us to provide a cost effective solution for noise reduction, thermal comfort and energy efficiency in the home or office.

Frame or Channel

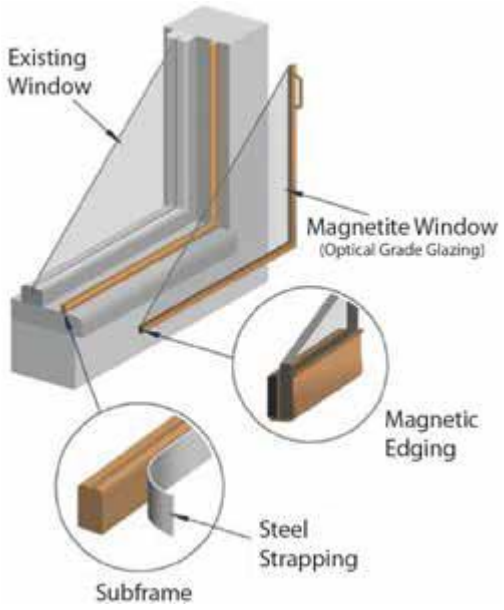
Framed with 1 1/2” PVC closed cell foam Galvanized steel banding

Magnetic Extrusion

Flexible and durable vinyl that will create a seamless finish

100% Virgin Acrylic

Optical grade, will not yellow or craze.



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Benefits & Advantages

- Significant savings on heating and cooling costs and lowers benchmark
- Completely eliminate drafts and air leaks
- Eliminates condensation that can cause early thermal and sill replacement
- 6 times more energy efficient than glass reducing carbon footprint
- Reduces outside noise pollution by up to 25 decibels
- Stops 96% of harmful UV light
- Optical grade 3mm 100% virgin acrylic panel
- 18 times stronger than glass and does not shatter
- Aesthetically appealing with no visible reduction in transparency
- Panel will not craze or yellow
- Typically 25% of the cost of complete window replacement
- May qualify for energy utility incentives or tax credits
- No messy construction and nothing for the landfill
- More comfortable environment means less vacancy

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Energy Utility Incentives and GHG Reduction Programs

IESO has Building Envelope and HVAC Custom Solutions.

Gas Utilities have insulation incentives and this is an insulator not a new window.

ESCO's are now specifying Magnetite as an option for long term savings.

New focus on GHG is addition to energy in the Climate Action Plan.

Large emitters have Cap and Trade and are looking for any GHG reduction.

Global Corporations reporting to Carbon Disclosure Project need to reduce GHGs.

Ontario Smart Grid Forum Corporate Partners Committee working on Innovation.

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Questions?

Block Out Harmful UV Rays

Reduce Noise by 70%

Energy Efficient

Cost Savings

Going Green

Increase R Value

Seal Out Drafts & Leaks

CANADIAN STANDARDS ASSOCIATION

Magnetite CANADA

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